Chile's Green Hydrogen Strategy and opportunities

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Ministerio de Energía
Gobierno de Chile

June, 2021


In 2021
we doubled
our solar & wind
capacity
+ 6 GW
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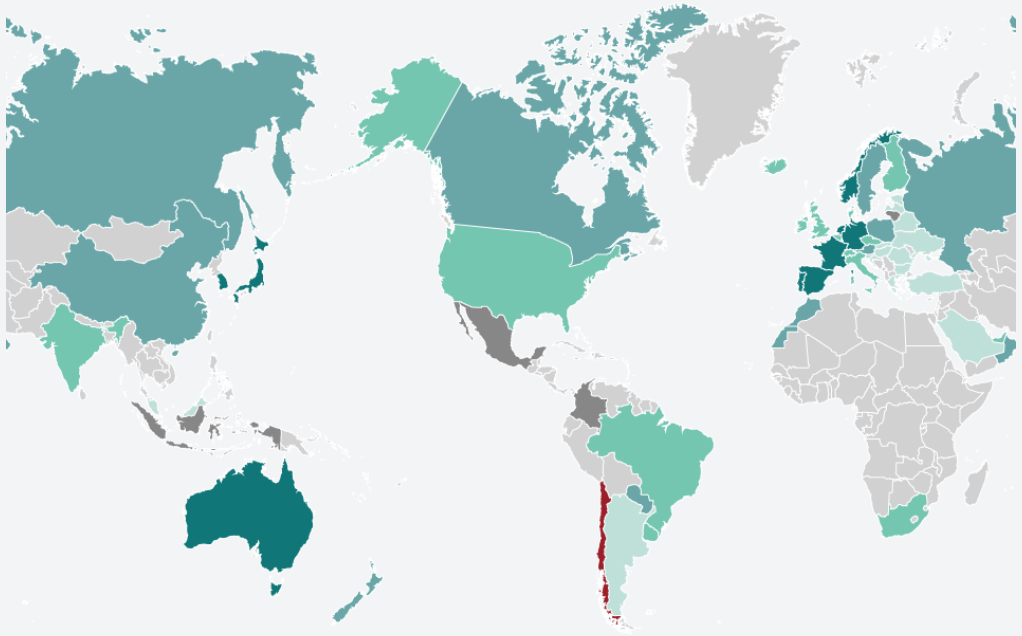
The time for hydrogen has arrived

Almost 90% of global GDP has put forward hydrogen support policies or initiatives

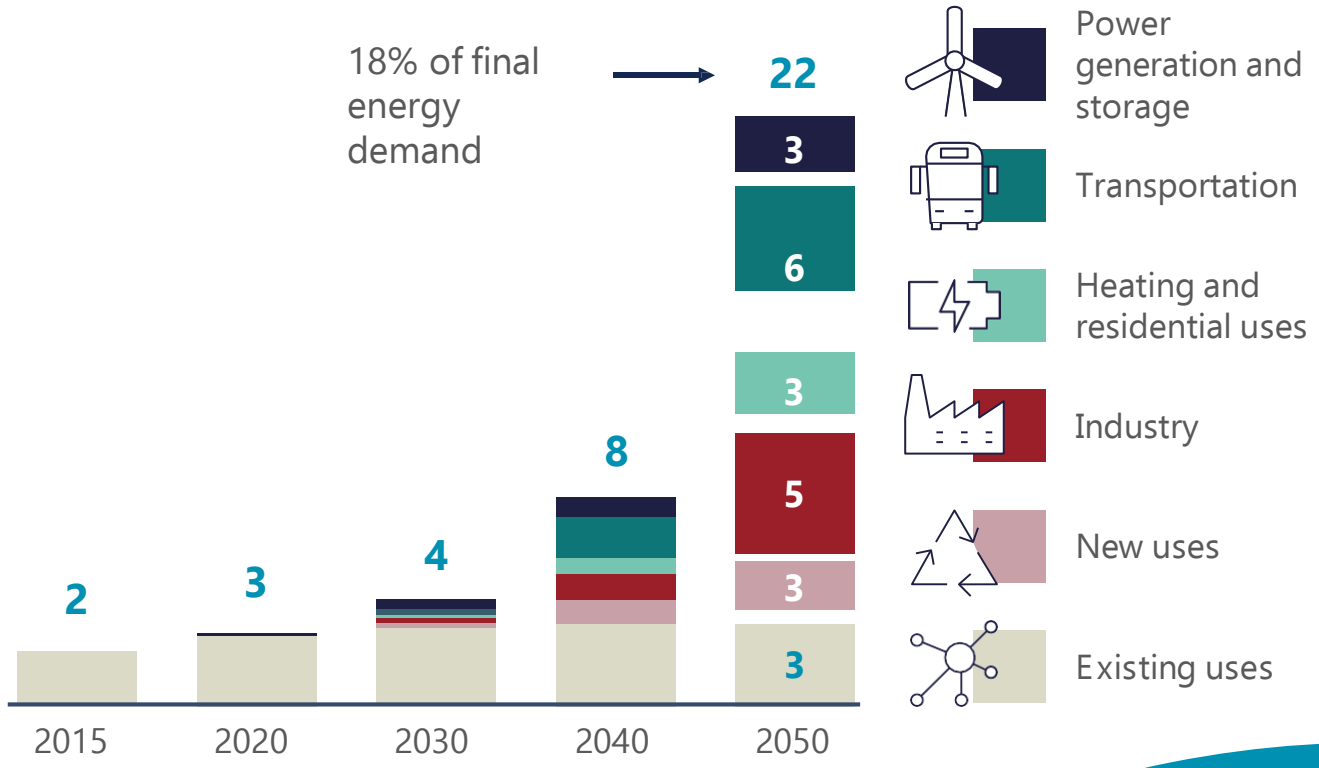
Source: LBST



- National strategy available
- National strategy under preparation
- Pilot and demonstrative project support
- Preliminary discussions
- No relevant activities
- Not evaluated

Global energy demand supplied by hydrogen (PWh)

Source: Hydrogen Council



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A country with abundant renewable resources

Renewable energy potential (GW)

Source: Ministry of Energy

587 GW
Concentrated Solar power

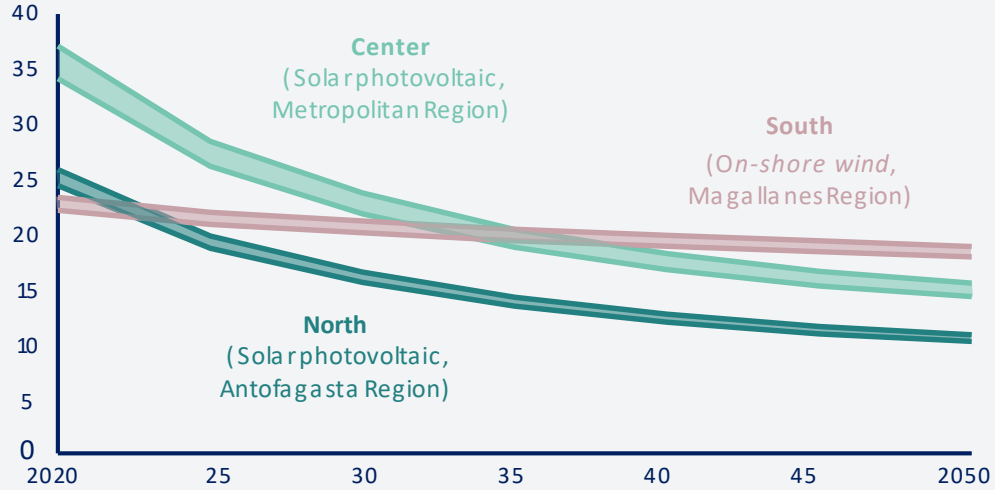
879 GW
Solar photovoltaic

15 GW
Run of river hydro

295 GW
On-shore wind

Levelized cost of renewable electricity (USD/MWh)

Source: McKinsey & Co.



The most powerful solar radiation on the planet is found in northern Chile

Solar generation in the central part of Chile is already more competitive than fossil- powered electricity generation

Winds in the far south end of the country are as strong inland as they are off-shore

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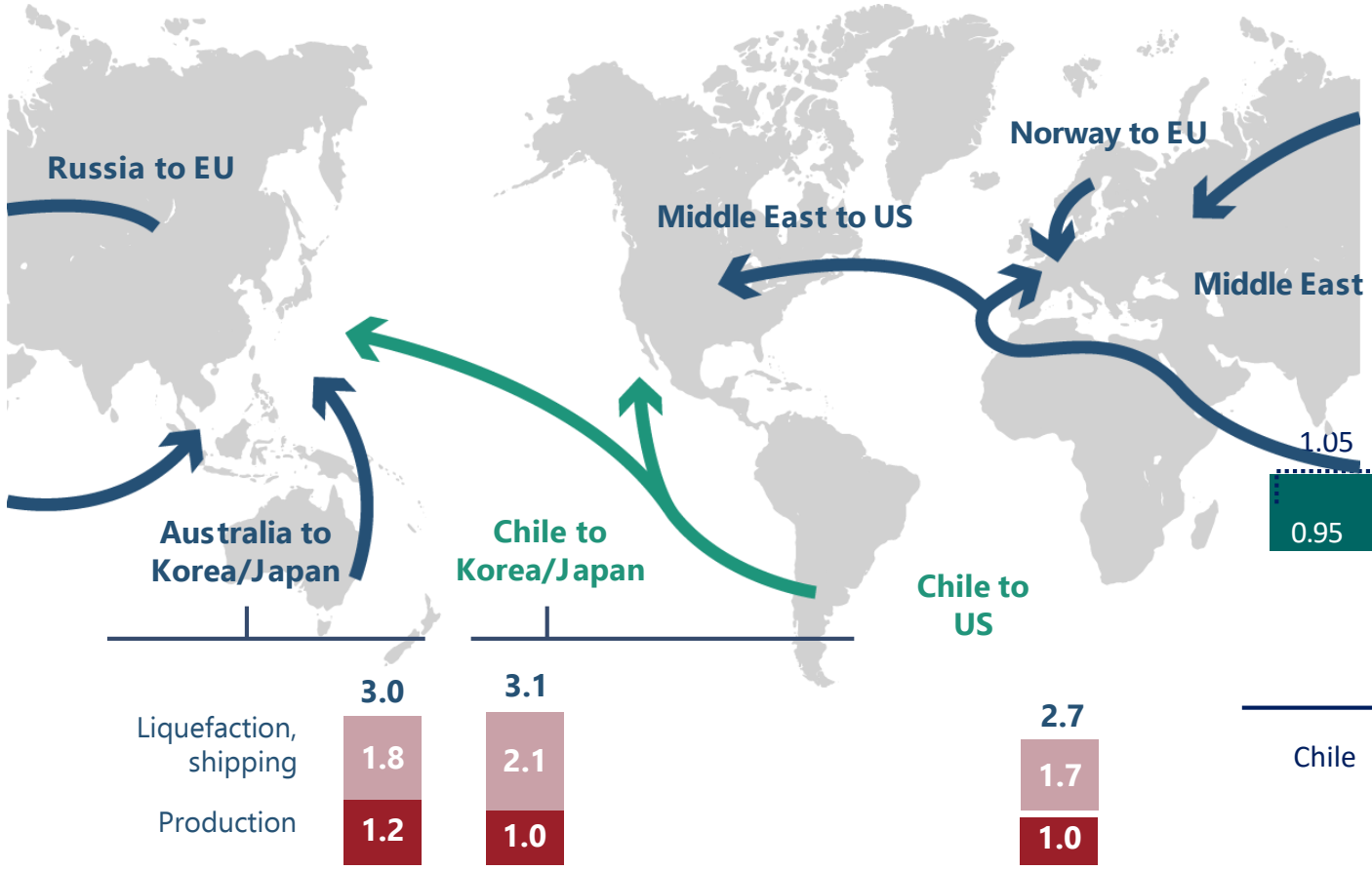
Latest estimations put Chile around 1 USD/kg by 2030

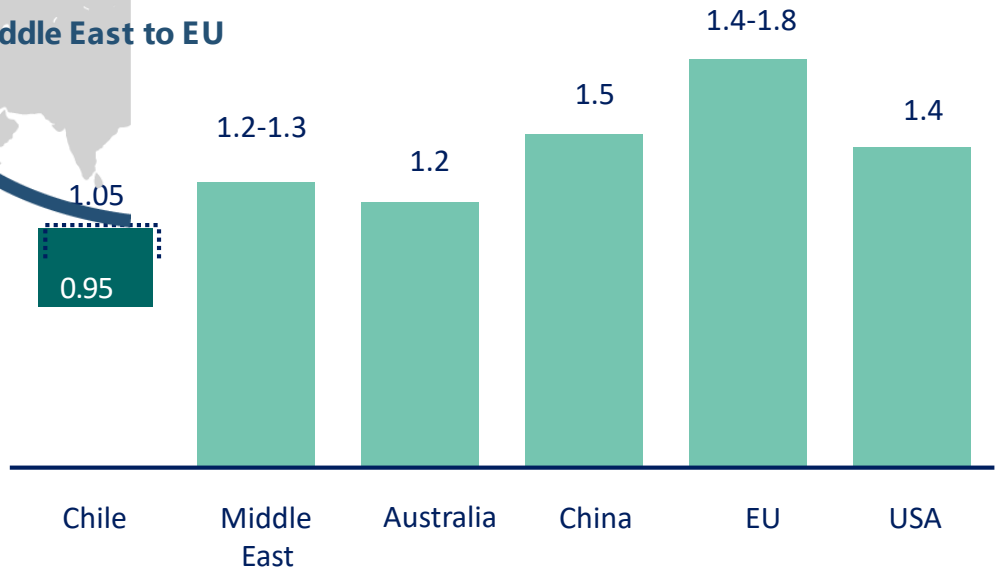
Despite distance to markets, Chile remains competitive in H2



Levelized cost of production by 2030 (USD/kg H_2)

Does not consider conditioning, transport, storage nor distribution costs

Source: McKinsey & Co.

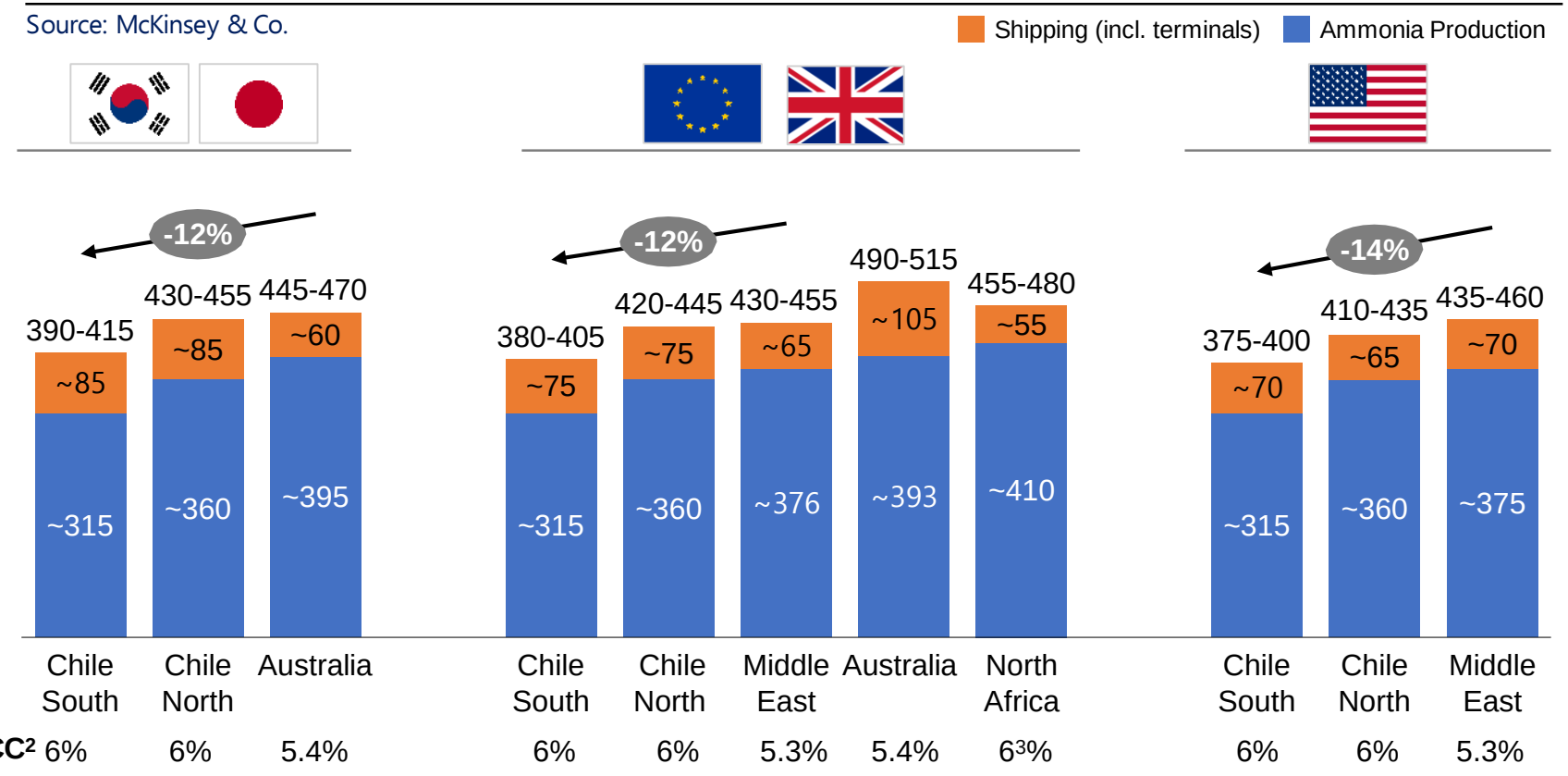


For easier to transport derivatives such as ammonia, Chile has a clear cost advantage

Ammonia total landed cost at destination site for prioritized countries

USD/Mton of NH3; Year 2030

Source: McKinsey & Co.



1.Includes liquefaction | 2. Relative differences in WACC vs. Chile estimated from country specific renewable project financing | 3 WACC assumption for Morocco
Note: Costs for at scale production and transportation (9,000-10,300 tons H2); Costs accounting for losses during transportation

NH3

Insights

Chile´s competitive advantage in low-cost green ammonia production makes it the most competitive importer option for prioritized markets

These results remain similar until 2040

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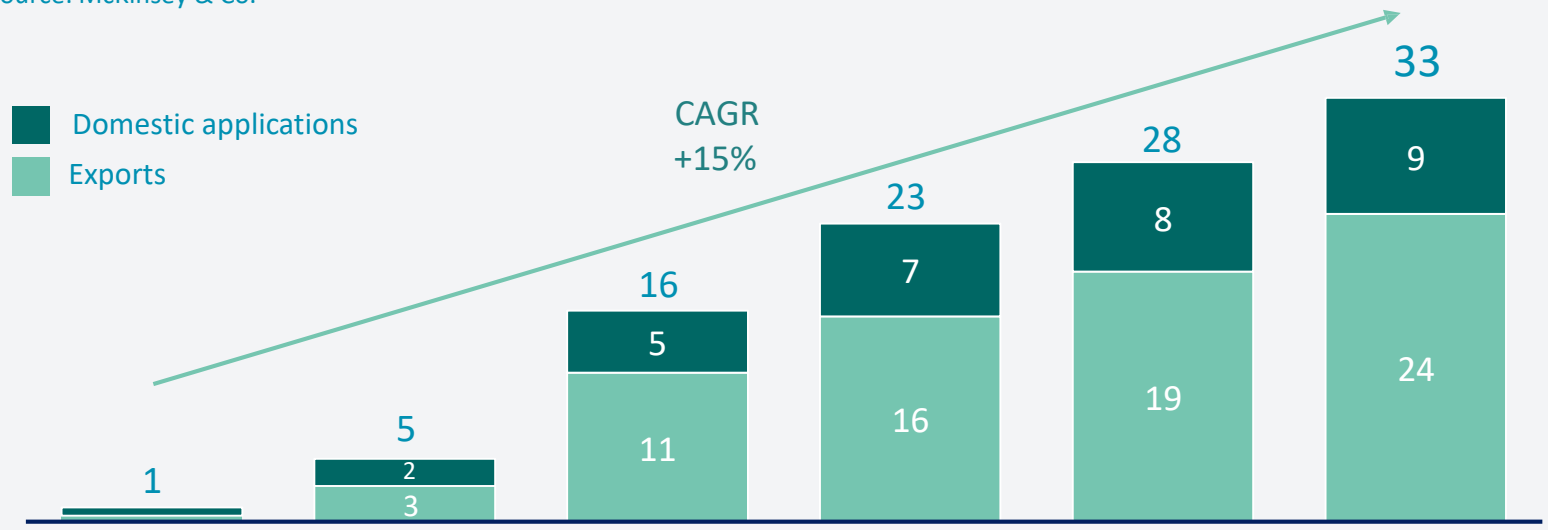
A unique opportunity: green hydrogen could be a clean industry as big as our mining sector

Projection of Chilean markets for green hydrogen and its derivatives (BUSD)

Source: McKinsey & Co.



	2025	2030	2035	2040	2045	2050
Associated renewable capacity (GW)	5-8	40	145	200	250	300
Cumulative necessary investment (BUSD)	8	45	150	220	270	330

The competitiveness of Chile in renewable energy production and the global need for clean energy carriers will open the door to the creation of an economic sector that could rival the size of the Chilean mining sector

If timely and effective action is taken, the use of green hydrogen in domestic applications will generate an industry prepared to compete in international export markets. Investment in green hydrogen will lead to significant national capabilities and the creation of dynamic economic ecosystems throughout the country

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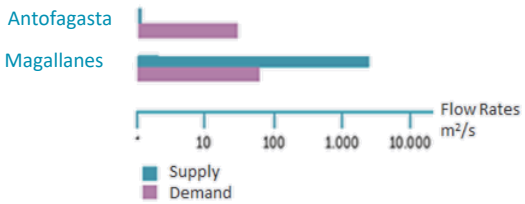
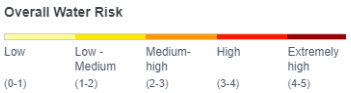
An industry that acknowledges water risk

Chile is the 18th

country in WRI's National Water Stress Ranking

However, water scarcity varies within regions





World Resource Institute, 2021; Red Agricola, 2019; Alarys, 2021

- **All announced projects set in the north consider desalination**

DISTRIBUTION OF TOTAL GLOBAL WATER:

- 97% Oceans
- 2,5 % Sweet water

- **Environmental challenges and stakeholder coordination**

SOME PRIORITIZED ASPECTS:

- Salinity levels of the discharged brine
- Naval permits

- **Required water for our Strategy:**

200 kton/year → Green hydrogen production by 2025

63 lt/s → Assuming 10 liters per kg of green hydrogen

1% → Of desalination installed capacity

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We have set clear goals to lead the way

2025

- **5 BUSD** — Top destination for green hydrogen investment in LATAM
- **5 GW** — Electrolysis capacity operating and under development
- **200 ktonne/year** — Production in at least 2 hydrogen valleys in Chile

2030

- Leaders in export of green hydrogen and derivatives — **2.5 BUSD/year**
- The cheapest green hydrogen on the planet — **<1.5 USD/kg**
- Leaders in production of green hydrogen via electrolysis — **25 GW**

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Achievements

In 12 months, Chile has achieved 6 key milestones for hydrogen

50 MUSD

First call for financing green hydrogen projects

Funding round for 10+ MW electrolizer facilities.

265 MUSD

Clean Technologies Institute

Open Innovation platform for clean energy and mining technologies.

Energy Efficiency Law

Energy efficiency standard for vehicles

Hydrogen and battery electric vehicles count x3. Accelerated depreciation.

International Reach

MoUs for collaboration and co-leadership of MIH2

MoUs with Singapur, Ports of Rotterdam, Antwerp, Brugges. Joint statements with UK, DE , FR, NE.

Fast-track piloting

3 guides for H2 tech in production, mining and transport

Streamlined approval processes for piolot initiatives.

>1 M USD

GH2 Dedicated international technical cooperation

Studies and funding with IADB, WB, AGCID, GIZ.

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60+ projects have sprung in Chile already

+15

USD billion projected investment by 2030

+1,200

kTonne H2 projected yearly production by 2030

+500

kTonne H2 projected yearly local consumption by 2030

+15

Projects have already defined their operations start date

Source: Ministry of Energy

HyExProject

Green ammonia production in the north of Chile for domestic and international consumption, replacing ENAEX ammonia imports

Atacama Hydrogen Hub Project

Large-scale electrolysis facility with export potential and hydrogen fuel cell powered freight train

Quintero Bay H_2 Hub Project

Production of green hydrogen in the central zone of Chile, close to potential offtakers

Green Steel Project

Green hydrogen blending into CAP's blast furnaces to reduce consumption of coke and eventually replace it entirely in their production of steel

HNH Energy Project

Large scale green ammonia production in Magallanes for export

HIF Project

Industrial-scale plant in Magallanes that will produce synthetic climate-neutral fuels for export

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Green hydrogen is a constant across Chilean energy policies

National Electromobility Strategy

Energy Transition Law:
Will address electromobility, green Hydrogen and NCRE

National Energy Policy

2050:
70% zero emission fuels (such as green hydrogen) in non-electric end energy uses

2040:
20% of the country's fuel mix is green hydrogen

2050:
Up to **40%** of electric demand driven by green hydrogen production for local uses

National Plan for Energy Efficiency

Long Term Climate Strategy

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This year we will launch our Economic Instrument Strategy

A scheme than enables the energy transition

INSTRUMENTS ASSESSED

- Carbon tax
- Fuel taxes
- Earmarking
- E missions trading systems
- Quota mandates
- Zero emission vehicles

TARGETS

35 USD / ton CO2
- Minimum carbon price

2030

100% sales are ZEV
- Light & medium duty vehicles
- Urban public vehicles

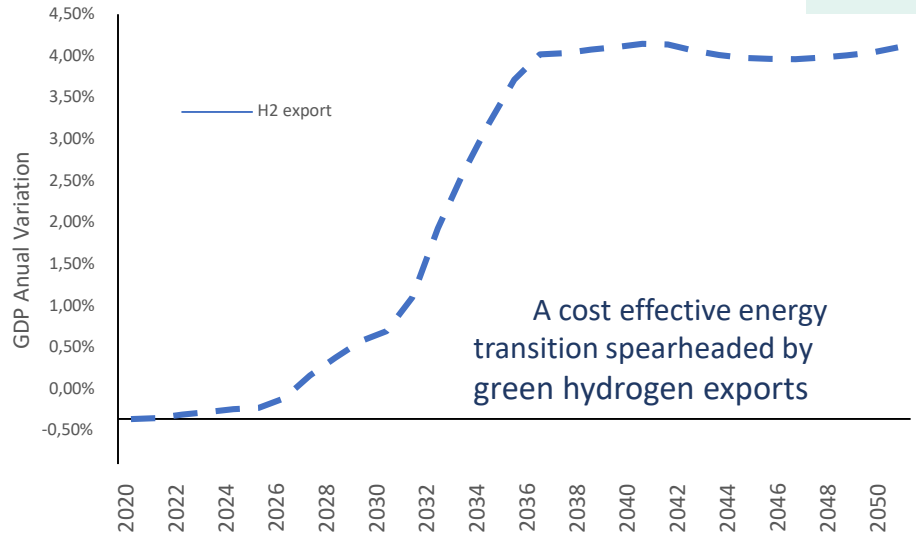
2035

15% zero emission fuels
- 70% zero emission fuels 2050

2035

MAIN PROPOSALS

1. Green Tax Reform
2. Creation of an Emissions Trading System
3. Revision of Fossil Fuel Tax Scheme



STUDIES SUSTAINING OUR STRATEGY

IDB Inter-American Development Bank

Options to achieve carbon neutrality in Chile:
An evaluation under uncertainty

THE WORLD BANK

Economic instrument schemes that catalyzes the energy transition needed to comply with Chile's NDC and net-zero GHG emissions goal

Green hydrogen deployment in Chile's domestic markets:
Definition of regulatory pathways to accelerate the energy transition.

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